Supplementary Information

Tree height and hydraulic traits shape growth responses across droughts in a temperate broadleaf forest

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While there were several R-packages we used for a specific purpose in our methods, numerous packages were immensely helpful for this research behind the scenes. As in all of science, this study is a representation of the work done by both the authors of this paper as well as countless others. While acknowledging everyone is impossible, we want to at least give thanks to those who made this work possible.

R-packages not already cited in the main manuscript include the following, listed alphabetically by corresponding package name:

(???; Wickham, 2019; Allaire *et al.*, 2020; R Core Team, 2020; Xie, 2020)

Table S1: Species-specific bark thickness regression equations

Species	Equations	R^2
Carya cordiformis	ln[B]=-1.56+0.416*ln[DBH]	0.226
Carya glabra	ln[B]=-0.393+0.268*ln[DBH]	0.040
Carya ovalis	ln[B]=-2.18+0.651*ln[DBH]	0.389
Carya tomentosa	ln[B]=-0.477+0.301*ln[DBH]	0.297
Fagus grandifolia	ln[B]=1*ln[DBH]	
Fraxinus americana	ln[B]=0.418+0.268*ln[DBH]	0.256
Juglans nigra	ln[B]=0.346+0.279*ln[DBH]	0.246
Liriodendron tulipifera	ln[B]=-1.14+0.463*ln[DBH]	0.545
Quercus alba	ln[B]=-2.09+0.637*ln[DBH]	0.603
Quercus prinus	ln[B]=-1.31+0.528*ln[DBH]	0.577
Quercus rubra	ln[B]=-0.593+0.292*ln[DBH]	0.087

Table S2: Species-specific height regression equations

Species	Equations	X.R.2.
Carya cordiformis	ln[H] = 0.332+0.808*ln[DBH]	0.874
Carya glabra	ln[H] = 0.685+0.691*ln[DBH]	0.841
Carya ovalis	ln[H] = 0.533+0.741*ln[DBH]	0.924
Carya tomentosa	ln[H] = 0.726+0.713*ln[DBH]	0.897
Fagus grandifolia	ln[H] = 0.708+0.662*ln[DBH]	0.857
Liriodendron tulipifera	ln[H] = 1.33+0.52*ln[DBH]	0.771
Quercus alba	ln[H] = 0.74+0.645*ln[DBH]	0.719
Quercus prinus	ln[H] = 0.41+0.757*ln[DBH]	0.886
Quercus rubra	ln[H] = 1.00+0.574*ln[DBH]	0.755
all	ln[H] = 0.839+0.642*ln[DBH]	0.857

Table S3: Monthly Palmer Drought Severity Index (PDSI), and its rank among all years between 1950 and 2009 (driest=1), for focal droughts.

year	month	PDSI	rank
1966	May	-2.98	2
	June	-3.40	2
	July	-4.08	2
	August	-4.82	1
1977	May	-2.96	3
	June	-3.28	3
	July	-3.61	3
	August	-3.68	3
1999	May	-3.63	1
	June	-4.21	1
	July	-4.53	1
	August	-4.64	2

Table S4. Individual tests of species traits as drivers of drought resistance, where Rt is used as the response variable.

		all droughts		1966		1977		1999	
variable	category	ΔAICc	coefficients	ΔAICc	coefficients	ΔAICc	coefficients	ΔAICc	coefficients
xylem porosity	R	-0.80	0.0630	2.29**	0.190	1.92*	-0.152	3.36**	0.1500
	D/SR		0.0000		0.000		0.000		0.0000
PLA		6.70	-0.0140	9.13**	-0.025	-0.32	-0.010	-0.95	-0.0070
LMA		-2.01	0.0002	-1.9	0.001	-1.68	-0.002	-2.03	0.0003
π_{tlp}		1.33	-0.1740	-1.65	-0.107	1.23*	-0.245	-0.1	-0.1690
WD		-1.97	-0.0310	-1.26	-0.206	-1.44	-0.154	0.66	0.2720

Variable abbreviations are as in Table 2. ΔAICc is the AICc of a model excluding the trait minus that of the model including it.

*ΔAICc $>$ 1: variable meets ΔAICc criterion for inclusion in full model

**ΔAICc $>$ 2: variable is considered significant as an individual predictor (and meets ΔAICc criterion for inclusion in full model)

Table S5. Individual tests of species traits as drivers of drought resistance, where Rt_{ARIMA} is used as the response variable.

		all droughts		1966		1977		1999	
variable	category	ΔAICc	coefficients	ΔAICc	coefficients	ΔAICc	coefficients	ΔAICc	coefficients
xylem porosity	R	-1.46	0.0430	0.95	0.1520	2.84**	-0.171	2.27**	0.155
	D/SR		0.0000		0.0000		0.000		0.000
PLA		4.5**	-0.0120	10.15**	-0.0240	-0.9	-0.008	-1.67	-0.005
LMA		-1.99	-0.0003	-2.02	0.0005	-0.42	-0.003	-1.9	0.001
π_{tlp}		0.41	-0.1500	-1.94	-0.0530	-0.53	-0.179	0.04	-0.200
WD		-1.94	-0.0400	-0.08	-0.3040	-1.57	-0.142	0.83	0.316

Variable abbreviations are as in Table 2. ΔAICc is the AICc of a model excluding the trait minus that of the model including it.

**ΔAICc > 2: variable considered significant as an individual predictor

Table S6. Summary of top full models for each drought instance, where Rt is used as the response variable.

drought	ΔAICc	R^2	Intercept	$ln[H]$	$ln[TWI]$	$ln[H] * ln[TWI]$	PLA	π_{tlp}
all	**0.000**	**0.12**	**1.131**	**-0.057**	**-0.086**	**-**	**-0.012**	**-0.113**
	0.583	0.11	1.423	-0.055	-0.086	-	-0.013	-
	0.726	0.12	1.537	-0.202	-0.326	0.082	-0.012	-0.114
	1.352	0.11	1.826	-0.198	-0.324	0.081	-0.013	-
1966	**0.000**	**0.25**	**1.622**	**-0.135**	**-**	**-**	**-0.025**	**-**
1977	**0.000**	**0.22**	**0.503**	**-**	**-0.144**	**-**	**-**	**-0.24**
	0.908	0.21	1.069	-	-0.144	-	-	-
	0.988	0.22	0.568	-0.03	-0.139	-	-	-0.246
	1.144	0.24	0.684	-	-0.142	-	-0.007	-0.204
	1.267	0.22	1.211	-	-0.141	-	-0.01	-
1999	**0.000**	**0.18**	**1.061**	**-**	**-0.102**	**-**	**-**	**-**
	0.023	0.19	0.659	-	-0.101	-	-	-0.169
	0.954	0.19	1.157	-	-0.1	-	-0.007	-
	1.513	0.21	0.783	-	-0.1	-	-0.005	-0.145
	1.803	0.18	1.024	0.013	-0.103	-	-	-
	1.901	0.19	0.635	0.011	-0.102	-	-	-0.166

Models are ranked by AICc. Shown are all models whose AICc value falls within 2.0 (ΔAICc<1) of the best model (bold).

Table S7. Summary of top models for each drought instance, where Rt_{ARIMA} is used as the response variable.

drought	ΔAICc	R^2	Intercept	$ln[H]$	$ln[TWI]$	$ln[H] * ln[TWI]$	PLA	π_{tlp}	$(1\|sp)[novariables]$
all	**0.000**	**0.09**	**1.125**	**-0.307**	**-0.506**	**0.140**	**-0.012**		
	0.425	0.10	0.879	-0.310	-0.508	0.140	-0.011	-0.096	
	1.208	0.09	0.424	-0.060	-0.100		-0.012		
	1.695	0.10	0.178	-0.061	-0.100		-0.011	-0.095	
1966	**0.000**	**0.23**	**1.660**	**-0.154**			**-0.024**		
	1.393	0.23	1.735	-0.152	-0.047		-0.024		
	1.457	0.23	1.859	-0.152			-0.025	0.078	
1977	**0.000**	**0.16**	**1.130**		**-0.180**				
	0.424	0.16	2.453	-0.461	-0.896	0.250			
	0.688	0.17	0.720		-0.179			-0.173	
	0.922	0.17	2.040	-0.466	-0.898	0.251		-0.180	
	0.927	0.17	1.248		-0.177		-0.008		
	1.322	0.17	2.569	-0.461	-0.893	0.250	-0.008		
	1.709	0.15	1.183	-0.020	-0.177				
1999	**0.000**	**0.20**	**0.563**		**-0.076**			**-0.200**	
	0.064	0.19	0.421					-0.202	
	0.127	0.18	1.036		-0.077				
	0.256	0.18							0.899
	1.777	0.20	0.529	0.016	-0.078			-0.195	
	1.797	0.20	1.101		-0.076		-0.004		
	1.815	0.18	0.986	0.018	-0.079				
	1.838	0.20	0.972				-0.005		
	1.933	0.19	0.391	0.012				-0.199	
	1.979	0.21	0.612		-0.075		-0.002	-0.190	
	1.999	0.21	0.482				-0.002	-0.190	

Models are ranked by AICc. Shown are all models whose AICc value falls within 2.0 (ΔAICc<1) of the best model (bold).

Allaire J, Xie Y, McPherson J, Luraschi J, Ushey K, Atkins A, Wickham H, Cheng J, Chang W, Iannone R. **2020**. *Rmarkdown: Dynamic documents for r.*

R Core Team. **2020**. *R: A language and environment for statistical computing.* Vienna, Austria: R Foundation for Statistical Computing.

Wickham H. **2019**. *Stringr: Simple, consistent wrappers for common string operations.*

Xie Y. **2020**. *Knitr: A general-purpose package for dynamic report generation in r.*

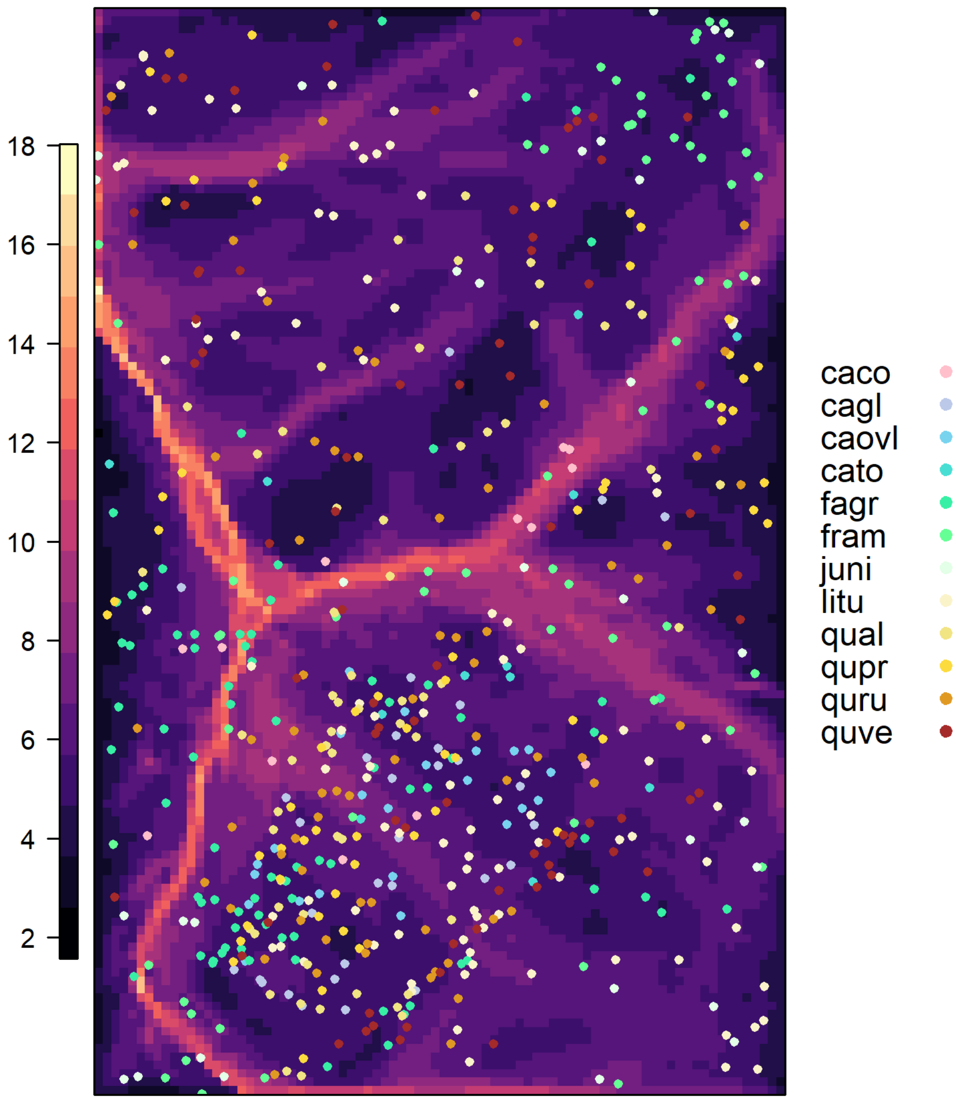

Figure S1: Map of ForestGEO plot showing TWI and location of cored trees

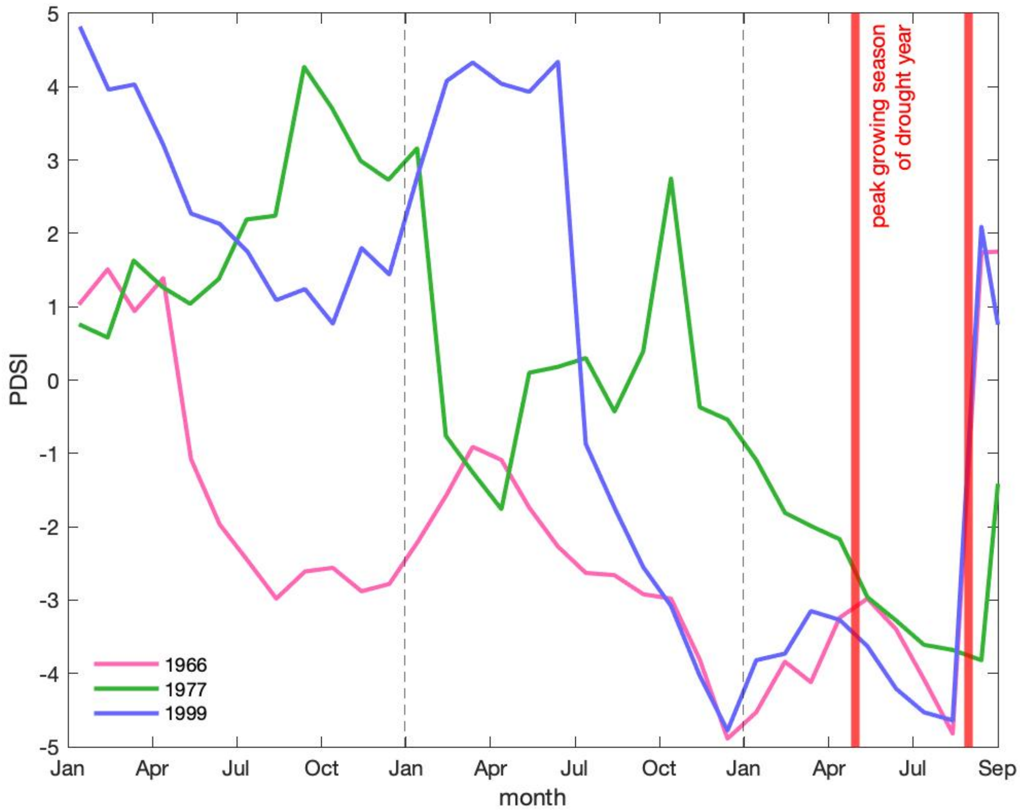

Figure S2: Time series of Palmer Drought Severity Index (PDSI) for the 2.5 years prior to each focal drought

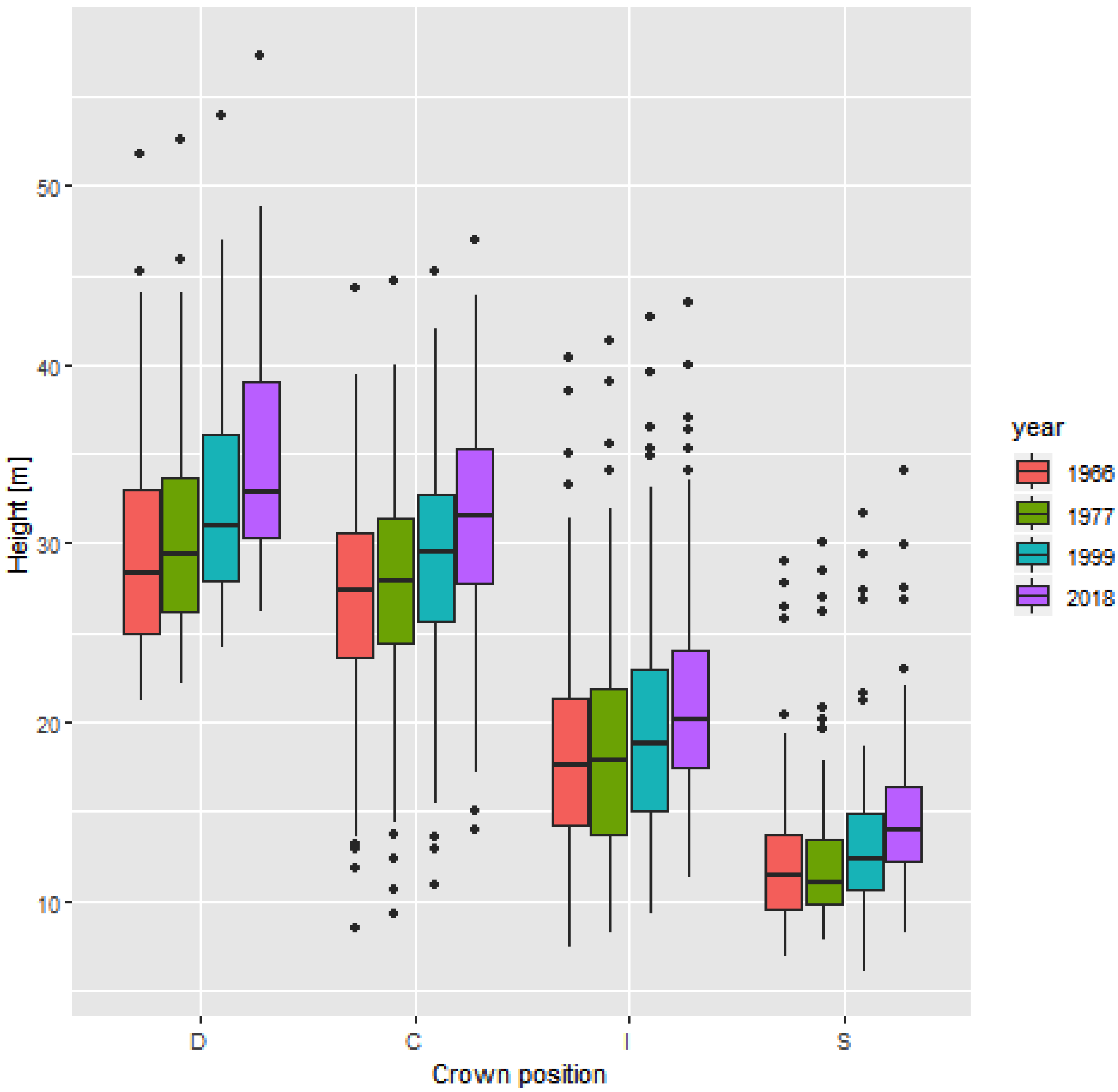

Figure S3: Height (from reconstructed DBH) by crown position across the three focal droughts and in the year of measurement (2018)

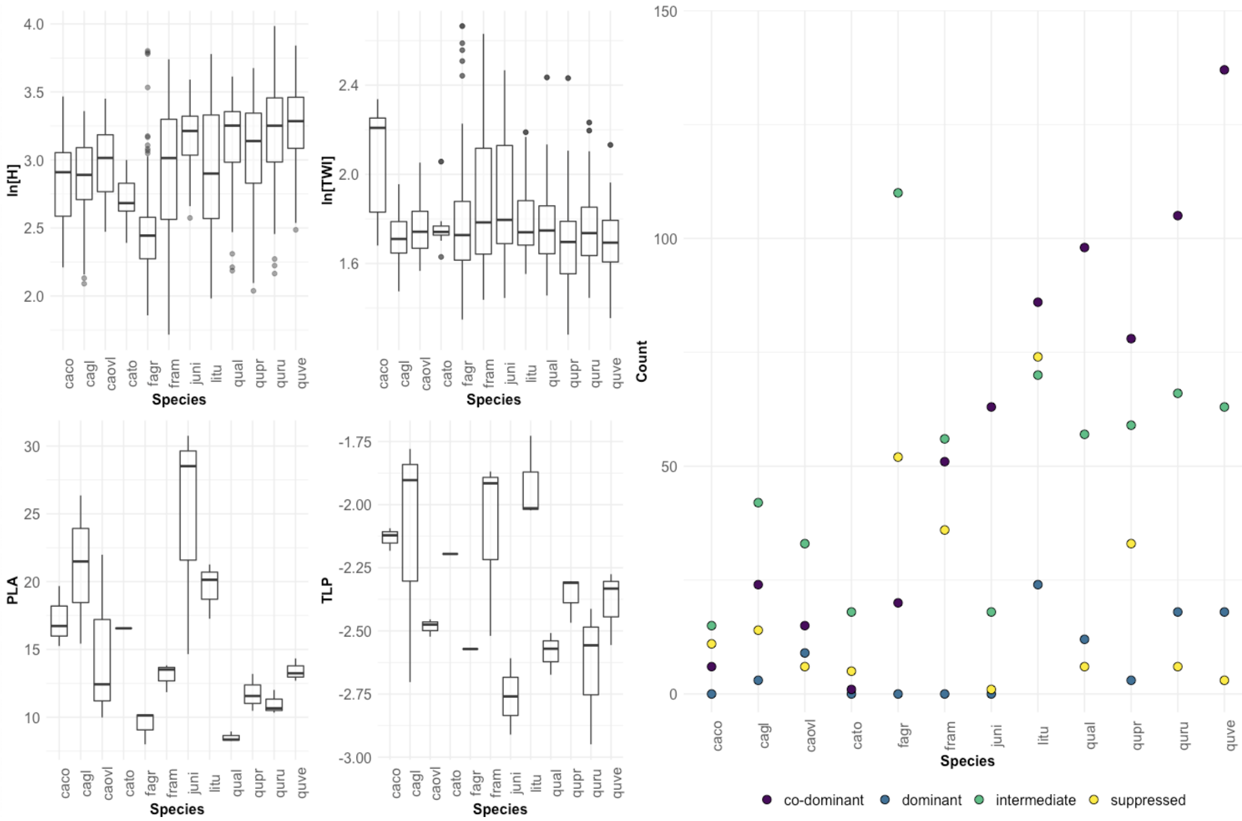

Figure S4: **PLACEHOLDER**

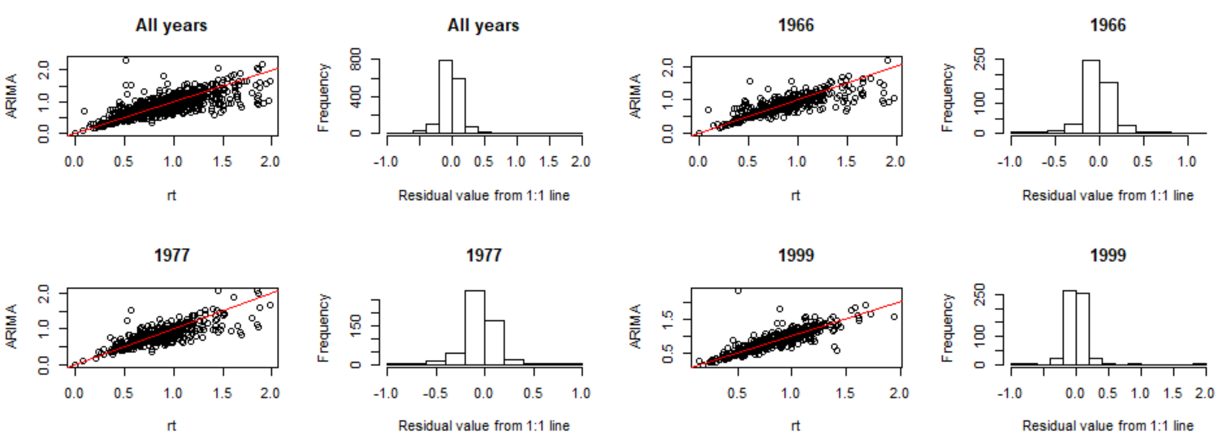

Figure S5: Comparison of Rt and Rt_{ARIMA} results, with residuals, for each drought scenario

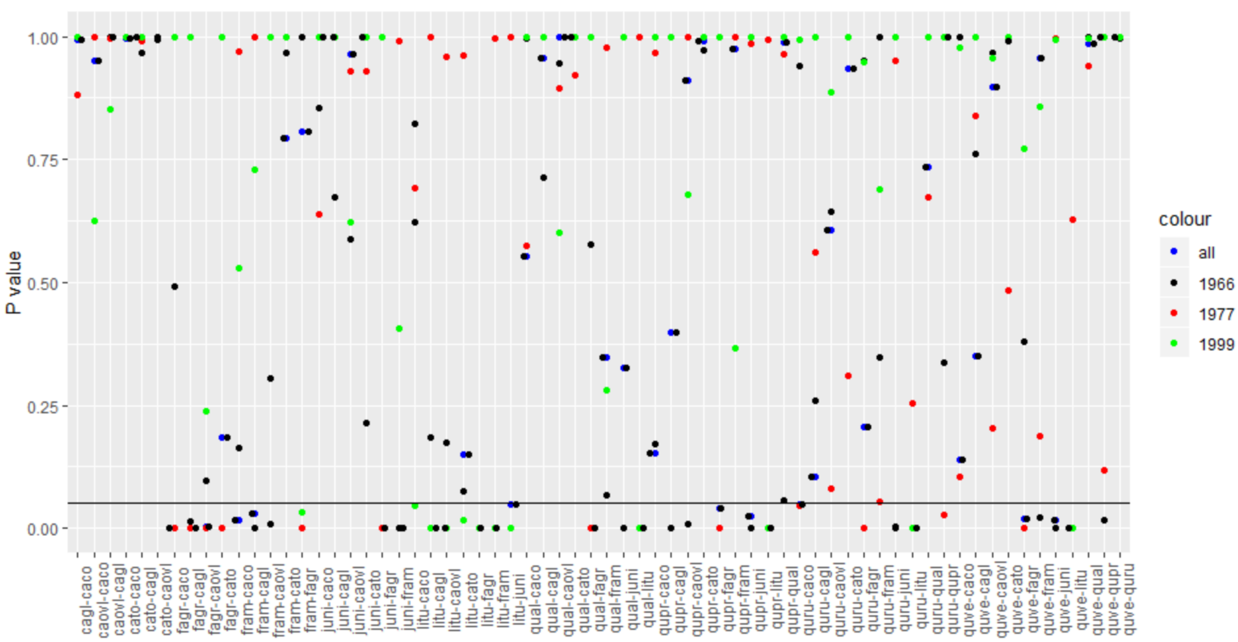

Figure S6: **PLACEHOLDER**